

CLAIMS

1. An article for delivering a drug and a nucleic acid, the article comprising:
a nanoparticle having a first portion capable of associating a nucleic acid and a
5 second portion capable of associating a drug.
2. An article as in claim 1 wherein the nanoparticle is capable of associating with
and maintaining association with a nucleic acid and a drug under non-physiological
conditions, and of disassociating the nucleic acid and drug under physiological
10 conditions.
3. An article as in claim 1 wherein the nanoparticle is capable of passing through a
cell membrane.
- 15 4. An article as in claim 1 wherein the nucleic acid is DNA
5. An article as in claim 1 wherein the drug is a cancer drug
6. An article as in claim 1 wherein the article forms a micelle
20
7. An article as in claim 6 wherein a drug is associated with an interior of the
micelle and a nucleic acid is associated with an exterior of the micelle.
8. An article as in claim 1 wherein the nanoparticle is stable at a concentration of
25 greater than 5 mg/L.
9. An article as in claim 1 wherein the nanoparticle is capable of crossing the
blood/brain barrier.
- 30 10. A composition comprising an article of claim 1 and a pharmaceutically
acceptable carrier.

11. An article as in claim 1 wherein the nanoparticle comprises a graft co-polymer having a backbone including tertiary amines, at least a portion of the tertiary amines quaternized and bound to a hydrophobic side chain.

5 12. An article as in claim 11 wherein the hydrophobic side chain comprises cholesterol.

13. An article as in claim 11 wherein the polymeric backbone comprises a copolymer of quaternized and non-quaternized tertiary ammonium groups.

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14. An article as in claim 13 wherein the polymeric backbone further comprises an ester linkage.

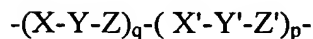
15. An article as in claim 13 wherein the polymeric backbone comprises a polyester.

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16. An article as in claim 13 wherein the polymeric backbone further comprises a polyether.

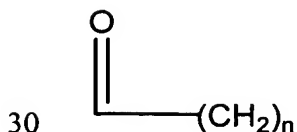
17. A composition comprising a chemical having the structure:

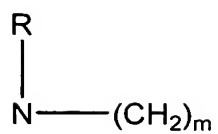
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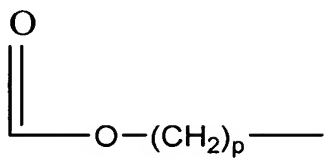
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wherein X, Y and Z, are selected, independently, from





and/or

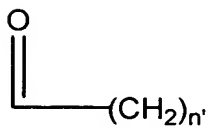
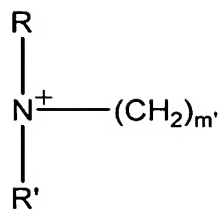


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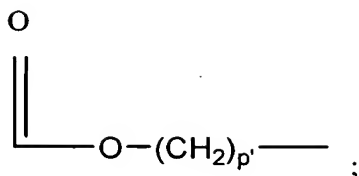
and

at least one of X', Y' and Z' includes R', and X', Y' and Z' are selected, independently,
from

10



15 and/or



- 5 wherein, R is H, an alkyl or a substituted alkyl,
R' is a hydrophobic group; and
n, m, p, n', m' and p' are greater than zero.
18. A polymeric structure comprising the chemical structure of claim 17 wherein the
10 polymeric structure forms a core-shell nanoparticle having an interior and an exterior.
19. A polymeric structure as in claim 18 having a diameter less than 20 μm .
20. The polymeric structure of claim 18 having a diameter of greater than 10 nm and
15 less than 1000 nm.
21. The polymeric structure of claim 18 wherein the polymeric structure exhibits a
zeta potential of greater than 40 mV.
- 20 22. The polymeric structure of claim 18 wherein the polymeric structure has a critical
association constant of less than 100 mg/L.
23. The polymeric structure of claim 18 wherein the polymeric structure has a critical
association constant of less than or equal to 9.6 mg/L.
- 25 24. A method of delivering a non-nucleic acid drug to a subject comprising:
associating the non-nucleic acid drug with the polymeric structure of claim 18 to
form a drug delivery vehicle; and
administering the drug delivery vehicle to the subject.
- 30 25. A method of delivering a nucleic acid to a subject comprising:

associating the nucleic acid with the polymeric structure of claim 18 to form a nucleic acid delivery vehicle; and

administering the nucleic acid delivery vehicle to the subject.

- 5 26. A method of administering a drug and a nucleic acid to a subject comprising:
 providing a drug/nucleic acid complex, the complex including a non-nucleic acid
 drug associated with a nucleic acid; and
 delivering the complex to the subject.
- 10 27. A method as in claim 26 wherein the drug and nucleic acid are each associated
 with a common nanoparticle.
28. A method as in claim 26 wherein the drug and nucleic acid are administered
 concurrently to a cell.
- 15 29. A method as in claim 26 wherein the nucleic acid is DNA or siRNA
30. A method as in claim 27 wherein the nanoparticle comprises a polymer.
- 20 31. A method as in claim 30 wherein the nanoparticle forms a micelle
32. A method as in claim 27 wherein the nanoparticle includes a polar region and a
 hydrophobic region.
- 25 33. A method as in claim 27 wherein the nanoparticle exhibits a cytotoxicity of less
 than polyethyleneimine (PEI) or lipofectamine
34. A method as in claim 27 wherein the nanoparticle exhibits an IC₅₀ of greater
 than or equal to 160 mg/L.
- 30 35. A method as in claim 26 wherein the wherein the complex is delivered orally.
36. A method as in claim 26 wherein the wherein the complex is delivered locally.

37. A method as in claim 26 wherein the wherein the complex is delivered intravenously.
- 5 38. A method as in claim 26 wherein the wherein the complex is delivered transdermally.
39. A method as in claim 26 wherein the wherein the complex is delivered parenterally.
- 10 40. A method of making a drug delivery composition comprising:
providing a fluid comprising a polymer and a drug;
allowing the polymer to form a micelle having an interior and an exterior, the
drug being associated with the interior of the micelle; and
15 associating a nucleic acid with the exterior of the micelle.
41. A method as in claim 40 wherein the ratio of drug to nucleic acid is pre-determined.
- 20 42. A method as in claim 40 further comprising drying the micelle.
43. A method as in claim 42 further comprising forming a powder comprising the micelle.
- 25 44. A kit comprising:
a container including an amphoteric polymeric nanoparticle;
a drug associated with a first portion of the nanoparticle;
a nucleic acid associated with a second portion of the nanoparticle; and
instructions for administering the nanoparticle to a subject.
- 30 45. A kit comprising:
a container including an amphoteric polymer capable of associating both a
nucleic acid and a non-nucleic acid drug ; and

instructions for associating a non-nucleic acid drug and a nucleic acid with the polymer.

46. The kit of claim 45 wherein the polymer includes a hydrophilic backbone and a
5 hydrophobic branch chain.
47. The kit of claim 45 wherein the polymer is pegylated.
48. A composition of matter comprising:
10 a nanoparticle;
a non-nucleic acid drug associated with a first portion of the nanoparticle; and
a nucleic acid associated with a second portion of the nanoparticle.